

PM WORLD TODAY – PM ADVISORY – JANUARY 2012

## Schedule Estimation: Politics, Science, or Art?

Pragmatic considerations to scheduling pitfalls.

(Part two of a two part series)

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### 1. Schedule Estimation: The Art Introduction

In part one of this series, we discussed multiple scheduling pitfalls. There are the political aspects which often force you to a situation where you have a fixed customer end date, a moving start date based on negotiations or budget authorizations, and political pressures forcing little or no risk budget, and no risk buffer in the schedule. The schedule tools available to you have multiple faults all erring on the side of optimistic schedules, which produce schedules that range from optimistic to unachievable. Some of these scheduling pitfalls are:

- Path convergence not accounted for
- Near critical path not highlighted
- PERT and Monte Carlo simulation overly optimistic because of flawed assumptions
- Makes no allowance for deteriorating problems early on in a project
- Even the worst case scenario is overly optimistic
- Makes no allowance for learning curves and ramp up of staff or does a poor job of it
- Assumes funds and resources will be available as scheduled

When we look at more complex programs in the mid to large size, what do you do to avoid these issues and what do you do when you find yourself in the situation where you have these issues?

### 2. Schedule Estimation: The Art

Each program and program team is unique and there is no “One size fits all” solution. Key to develop a schedule and estimate for a program is planning the overall proposal effort up front and scaling the detail of your proposal to the time and resources you have available. If detail is lacking you have to limit the scope and bound with assumptions.

Apply sound governance techniques to manage upward with your management and client to ensure that your scope, schedule and cost are in alignment and well document with basis of estimate.

A detailed list of deliverables, documented within a deliverables base WBS, will give you basis to control and document scope. Assumptions will help to document what is not in scope.

Bottom up and top down estimates done by experienced SMEs will give you the best possible cost baseline. This technique has consistently proven to me more accurate than any other.

The resulting schedule built using the tools available, augmented by techniques to overcome their built in optimistic pitfalls will provide the best schedule estimate available.

In order to facilitate the discussion on the art of schedule estimation, we have decomposed the discussion into a series of key subtopics.

## **2.1. Proposal**

Proposals, whether internal or external, are small projects in and of themselves. You need to start with a work plan and schedule. The schedule must be developed starting with the end date and scheduling backwards to the beginning. You must account for all proposal milestones that must be met including cost submission, approvals, etc. The remaining time to actually produce the proposal dictates the level of detail and type of proposal you can produce. With more time you may be able to produce detailed descriptions for your solution. With less time, you may have to describe your solution at a higher level or even as a PowerPoint presentation. Whatever level of detail you have, you need to set the expectations around commitments, assumptions, risks and change control to match.

However much time you have to produce the proposal, remember that you have to produce a definition of scope, an estimate of the cost, risk and schedule, document your assumptions, obtain necessary quotations and commitments, and gain management approvals in time to meet client submission dates and your plan must meet all of the related dates. So the customer requires it on date Z, management needs a complete package for approval by Z-Y, finance needs to all of your materials to complete pricing by (Z-Y)-X, partners and subcontractors need final materials from you by (Z-Y-X)-W in order to provide firm quotations, you need a final costs by (Z-Y-X-W)-V, you need a final schedule by, etc. etc. This often leaves you far less time than you would think to actually analyze client requirements, develop a solution and write a proposal. Telling your management that your client opportunity is “Strategic” is not going to be an acceptable excuse for failing to plan for these various gateways.

## 2.2. Governance

It is critical to have both your management and your client engaged as part of the overall estimation process. The client needs to be engaged to help establish overall priorities so that when trade-offs need to take place amongst the triple constraints of cost, schedule and scope, you are making the correct trade-offs in accordance with the client's desires, objectives and risk tolerances. The client may be especially schedule driven due to market windows or specific business milestones. The client needs to have visibility into the risks (both threats and opportunities), responses and solutions and the trade-offs there as well.

Management often wants to cut cost in order to reduce price while maintaining margins. The same thing may happen if they are trying to fit within an internal budget or budget reduction. This is actually erroneous estimation unless supported by real estimates with sound basis of estimate and possibly scope reduction. It is key to get agreement on the amount of work involved, as costs are derived directly from it. For each activity the basis of estimate should show how the cost and schedule estimate was derived at a detailed level showing the justification for the estimates. You can reduce scope, defer scope to later phases, adjust schedules in ways to reduce cost etc. but otherwise, you should stick by your cost and schedule estimates. This interaction with management may well happen at least twice. It will happen when you submit your initial budgets and also during client negotiations, which may be an iterative process. You should not assume that if you "give a little" on cost, that you are done. Once you start to "give a little" management may come to you multiple times. That is a very slippery slope. Management may want to take a percentage off the cost. Always take them back to the individual estimates and the basis of estimates. Take them to the individual estimates and talk to them about where they think cost and scope could come out. Your estimates have basis of estimate, percentages don't.

You should always document your assumptions, basis of estimate, schedule and risks so that your management and your client can never "forget" about them. They may have a tendency to only remember your budget and schedule. The initial plan is likely based on a preliminary set of requirements that will be refined as the program progresses. The client is also likely to learn more about their own requirements during this time and may need to include changes. It is prudent to include an assumption that at the end of each phase, a detailed plan for the following phase will be prepared which may result in a modification to the overall plan incorporating the iterative give and take that occurs as the process of discovery unfolds.

## 2.3. Scope

The first task in developing scope is to develop a complete list of deliverables. This needs to be a truly complete list including such mundane items such as invoicing or

status reporting requirements. If any requirements document or contract specifies something to be delivered, it is a deliverable. You should also document any information about the deliverable such as frequency, format, medium, where to be delivered, etc. You are only responsible for the deliverables specified, not the whole known universe as it relates to your program. Do not build, design, write, code, specify, test, and expand, etc. anything that is not in your list of deliverables or need in order to produce the list of deliverables. This list of deliverables, captured as part of your deliverables based Work Breakdown Structure (WBS), defines the scope and obligations of the Plan Of Record (POR). Document all assumptions in one place under change control using only reasonable assumptions. Assumptions further document scope by defining what is not in scope.

Many requirements can be read more than one way. Most organizations aren't looking for the most elegant technical solution. They are looking for a solution to a business problem. Elegant solutions cost them in solution price, implementation time, and impact on their organizations. Work with your SMEs to develop the lowest cost compliant solution to your client's problem. If your SMEs believe they have a more elegant solution worthy of consideration, propose it as an option or offer it under change control.

Your SMEs should be looking at simplifying your client's processes not automating flawed processes at greater expense. Not everything is a purchased solution, many things should stay as manual procedures, perhaps updated and redesigned.

Client's often come up with fixed end dates that are "must haves" because of business needs. You should push back and find out what the real underlying requirements are. Often a phased delivery approach with a significantly reduced subset of the total program requirements can meet that delivery date while actually relaxing the total program schedule. Consider off-the-shelf solutions that are close to compliant, working with the client to see if they are "good enough".

Phased deliveries also need to be broken into deliveries that are individually within the range of the client's Vision Capacity and within their organizational ability to embrace change. Phased deliveries should be packaged to individually deliver incremental value. When talking with your client and your management about doing phased deliveries, remember the axiom that "Every program builds a fast and nasty prototype - Some programs deliver them to the client."

Initiate discussions with the client about who takes which risks, responsibilities and what of participation in the program. These can have a significant impact on cost and schedule. If the client is unaware of such possibilities and tradeoffs, they can't take advantage of them.

## 2.4. Estimation

Estimation begins with putting together a team of Subject Matter Experts (SMEs). The estimates that will be produced are as good as the expertise, experience and tribal knowledge of that team. Intact teams that have worked together before will produce superior results over ad hoc teams for particular program estimates. But a caution here, the estimates must reflect the team doing the delivery of the program and their capabilities, not the capabilities of the estimating team if the teams are different. Every deviation from this should be reflected as an additional program risk.

Estimation begins with taking the fixed list of deliverables and reflecting it in a deliverables based Work Breakdown Structure. This type of WBS forces you to look at those deliverables that have commercial value to your client, that the client is will to sign off, take ownership of, pay for and accept. Those are the top level in your WBS. The next level down is the detailed list of all deliverables. Each of those detailed deliverables falls under one of those top level deliverables. If you are doing phased deliveries, then those phases would be top levels in your WBS. This approach forces you to think about what you are delivering leaving the how you will do it open to options. This allows for a more modular design. It also insures that you are meeting all of your contractual requirements. The alternatives available, process oriented WBS and organizational WBS have weaknesses that can allow unnecessary work to be done, work to be missed, and a narrowing of focus on approaches to solutions.

Once you have developed this deliverable based WBS, you can then have your subject matter experts decompose those deliverables into tasks and activities as appropriate and then develop cost and schedule estimates for them. This will allow you to develop a bottom up estimate for the program.

Bottom up estimates are very good at estimating what the SMEs have expertise in. SMEs are notoriously bad at missing tasks and activities they are not experts in and underestimating the work in areas other than their own. It is human nature to focus on the areas you know the most about and therefore risk underestimating the areas you know the least about. This is where the role of top down estimation comes to play. Reviewing the schedule and cost estimates from the top down, comparing it against industry norms, heuristic models, your own experience and other program in your organization, allowing you to identify problem areas and make adjustments to put them in line with historic evidence.

You want to try to get to an initial schedule and cost estimate as early as possible to help identify the issues you need to address before you have an acceptable schedule and cost estimate. It seems that the initial cost and schedule estimates are always more than is acceptable and the earlier you get a handle on that at least at a gross level, the sooner you can see where you need to focus your time. Working cost and schedule problem areas takes time and that is something you never have enough of when doing your estimates or putting together a proposal.

Now you are using the tools available to you. We have made a case for those tools being highly optimistic, but they are the tools available to you, so they are all you have. The key is to recognize those pitfalls and take them into account. Don't just put your data into these tools and then blindly rely on the results. Consider the following techniques in your schedule development:

- Storming, forming, norming and performing need to be accounted for in the schedule and facilitated to minimize the time involved
- Include kick-off and scope verification meetings in your schedule
- Use realistic staff ramp up time frames, don't assume everyone is available instantly with skills and experience you need
- Take into account if the team is new or if they have done this sort of program before
- Don't plan "free overtime" as part of the schedule
- Use Critical Chain technique: Add schedule buffers at points of high convergence (Solves path convergence and adds schedule risk in)
- Watch not just Critical Path activities but Near Critical Path activities. i.e. those items with small amounts of Total Slack
- Be dubious of real PERT estimates (3 point estimates) or Monte Carlo simulations. They produce skewed results. Studies have shown actual program results significantly worse, particularly on larger more complex programs
- Remember that quality in estimates come from the quality of your SMEs and tribal knowledge, not tools

Once you have your initial cost and schedule put together, you need to optimize in to improve the cost and schedule. Consider some of the following:

- Conduct risk analysis, both top down and bottom up
- Keep your risk estimates separate from your activity estimates, don't bake risk into activity estimates
- Look at risk response strategies of all types to reduce risk, reducing overall cost.
- Interact with the client – price, risk, schedule, scope and responsibility are tied together – if the client wants it faster or cheaper or better they need to understand how these all interact
- Consider different delivery locations, organizations and delivery models in developing cost and schedule estimates (off-shore, near-shore, on-shore, third party, outsourcing etc.)
- If cost and schedule are tight, scope management and change control will be difficult with the client and critical to do

## 2.5. Schedule

Just because a tool produces an end date based on a start date doesn't mean that is THE end date. Based upon many factors, schedules actually have probability distributions of end dates. There are many possible end dates for any program. Therefore, try and commit to a range of end dates. The program will end between x date and y date or the program will end in the x quarter of next year, etc. There is also no reason to commit to client dictated intermediate milestones unless there is some overriding business event to meet. Intermediate milestones should be yours, not theirs and they should be targets as well, not hard dates.

Nearly everyone thinks about risks when developing estimates and program plans. Many people develop risk budgets, some of which survive the eventual budget. A select few accommodate risk in their schedules. You may well have risk response plans for some of your risks and those should be incorporated into your plan and may affect your schedule. The impact of other risks occurring is going to affect your schedule. Those impacts to your schedule need to be accounted for. Use critical chain techniques to add schedule buffers at critical points to account for those schedule risks.

Don't use crashing and fast tracking as part of your plan. You need to reserve these techniques to respond as needed for when risks occur or other schedule impacts happen.

You should use the schedule with buffers to provide status and tracking with your management and your client. You should task your program team against a schedule without the schedule buffers. The difference is the safety zone, negotiated with the executive team, where you as a program manager survive.

## 3. Schedule Estimation: The Art: Summary

Developing an appropriate response to a client's request isn't just responding to business requirements, but understanding the complete business context of the program. It is vital to understand the clients priorities as well, in regards cost, schedule, quality, scope and any particular business milestones or market windows, so that when trade-offs are required, they can be made in accordance with the program goals and the clients desires.

Plan the proposal like a small project starting with the end date and working backwards taking all milestones and gateways into account and scale the detail of the proposal to the time you really have. Gather the best team of SMEs available for your proposal team.

Develop a solution which is minimally compliant to provide the lowest cost in the shortest time frame. Provide desirable alternatives as options in the proposal or as enhancements under change control as appropriate.

Develop a complete list of deliverables and include them in a deliverables based WBS. This becomes the foundation your Plan Of Record is built upon.

Consider alternative delivery resources and methods. Include the client in discussions of alternatives including assumptions, risks, alternative solutions and methods.

Use your SMEs to develop bottom up estimates in the framework of the WBS. Use top down estimates to sanity check the results and make adjustments based on historic performance, industry norms and tribal knowledge.

Have all cost and schedule estimates derived from basis of estimate tied to the WBS. Insist on any cost and schedule reductions to be paired with adjustments to those bases of estimate and that those adjustments are tied to reductions in scope, responsibilities, risks, assumptions etc.

We have multiple flaws in the tools and techniques available to us. Unfortunately, they all err on the side of creating more optimistic schedules. We aren't saying don't use these tools, they're what we have. We encourage you to use the tools you have, but recognize the limitations and utilize appropriate techniques to account for those limitations.

Provide schedule ranges rather than specific dates, since schedules are really probability distributions. Include schedule risk in your schedule estimates, not just risk cost in your cost estimates.

#### **4. Closing Remark**

We hope you enjoyed the concepts put forth in this second part of this article and that it will stimulate some lively discussion among you practitioners, researchers and tool developers alike. We will have the blog open for any such discussion on our web site [www.abysspm.com](http://www.abysspm.com) and welcome your participation. It is, after all, the human expertise and collaboration within the programs community that makes the difference in schedule estimation. As we exchange and challenge ideas, we build tribal knowledge that improves how well we all do.

## About the Authors

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**Dave Berry, PMP** is co-Managing Director of Abyss Program Management LLC, a Texas-based consultancy. Dave is an Information Technology & Program Management Executive experienced in consulting management, operations and troubled program recovery. During his career, he has analyzed situations, identified problems, proposed alternatives, and resolved situations for international companies in diverse industries. He has a unique ability to identify and capitalize on opportunities for organizational change and operational improvement. As a consultant, Dave managed the recovery of an enterprise e-commerce program for Sam's Club, involving numerous companies and hundreds of engineers, bringing the program from chaos to one of control and predictable performance in six months. At Hewlett Packard Dave was responsible for the multi-billion dollar customer program portfolio worldwide, monitoring the health of the larger programs, conducting reviews and responding to escalations. He worked with all company and client stakeholders to analyze the situation, determine the issues, develop the recovery plans and work with the teams in the execution of those plans. His efforts resulted in roughly \$50M in cost savings in 20 countries across 5 continents. As an operations executive, he went through mergers of Digital Equipment Corporation, Compaq and Hewlett Packard. He worked across all business units, functions and geographies, in developing and deploying many of the worldwide operational initiatives, to include such things as program reviews, account reviews, risk management initiatives and business governance initiatives. Dave was responsible for most of Hewlett Packard Service's program management methodologies and standards and most of the Hewlett Packard's custom program management training. At DEC Dave led the recovery of numerous large customer programs and managed DEC's consulting business for the South Central USA. Dave began his career in software engineering in defense contracting, working on large custom command, control, communications and intelligence systems. He managed staffs as large as 140 software engineering professionals. He was instrumental, during this time, in the development of software engineering and software project management methodologies. He has a BS in Computer Science from Angelo State University and an MS in Project Management

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